501.33745CX4/219400807US5

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Shunji MAEDA *et al.*
Appl'n No.	:	10/686,584
Filed	:	17 October 2003
For	:	MANUFACTURING METHOD OF SEMICONDUCTOR SUBSTRATE AND METHOD AND APPARATUS FOR INSPECTING DEFECTS OF PATTERNS OF AN OBJECT TO BE INSPECTED
Art Unit	:	2877
Examiner	:	Hoa Q. Pham
Conf. No	:	9360

PETITION TO MAKE SPECIAL
FOR SPECIAL ACCELERATED EXAMINATION UNDER MPEP §708.02(VIII)

Mail Stop Petition
Commissioner for Patents
POB 1450
Alexandria, Virginia 22313-1450

29 April 2004

Sir:

Applicant respectfully petitions the Commissioner to make the subject application SPECIAL for expedited examination and issue under the special procedures for accelerated examination as set forth at MPEP §708.02(VIII).

PRE-EXAMINATION SEARCH

SEARCH PARAMETERS

The search was broadly directed to finding a method of inspecting a semiconductor wafer pattern by providing a light source emitting light containing a plurality of wavelengths (a wide frequency bandwidth of light), then selecting a

predetermined wavelength range from the light source (*i.e.*, using a filter to select a more narrow range of light wavelengths), illuminating a patterned wafer with the light and detecting the image of the pattern based on the selected wavelength range (see Claim 43). Some claims define the use of a time delay integration sensor for detecting the image (see Claim 47). The illuminating optics can include an objective lens (see Claims 47 and 58). One key point appears to be that a broad-spectrum light source is used and then the light is "selected" or filtered to emit a more narrow range of predetermined wavelength range. This method is useful in situations where a transparent thin film is present on the object being observed. It is useful to select a wavelength range to accommodate a range of film thickness since a film thickness is not typically uniform.

The foreign priority date (7 October 1994) of the Japanese patent application claimed under 35 USC §119 in this case was used as the critical date for conducting this search.

Before conducting this search, the three related issued patents and their cited references were studied, excluding file histories. Related US 6,263,099 B1 has some claims containing the features/limitations of illumination of a predetermined wavelength range of light, but does not claim the use of a broad light source emitting plural wavelengths with selection of a predetermined wavelength range from the light source.

SEARCH RESULTS

4,692,690	Hara	5,131,755	Chadwick
4,816,686	Hara	5,162,867	Kohno
4,877,326	Chadwick	5,459,794	Ninomiya
4,999,510	Hayano	5,479,252	Worster
5,085,517	Chadwick	JAPAN 63-055445 A	

DISCUSSION OF SEARCH RESULTS

Chadwick '326 discloses a method and apparatus for optical inspection of substrates, including a light source for emitting a light containing a plurality of wavelengths, an illumination system having a filter that selects a predetermined range of wavelengths and means to process detected reflection signals. A time delay integration (TDI) sensor is suggested for use in inspecting the substrate. Note Col. 10, lines 43 through Col. 11, line 35 as well as Col. 17, lines 15+ and Col. 21, lines 21+. Interchangeable filter 915 in Figure 6 is a color filter that selects a predefined range of wavelengths from light emitted from a much broader range light source. The filter is provided on the reflection side of the observed object. Figure 6 shows a "sensing lens" 906 on the reflection side. Related reference Chadwick '755 is provided as well. In addition, Chadwick '517 discloses similar technology, but is not directly related to Chadwick '326. In Chadwick '517, note Figure 17b and Col. 20, lines 53+, disclosing wavelength range selection filters 913/914 used to block visible light from lamps 1601/1602 and pass short wavelength light (less than 500nm) before striking the substrate. Chadwick '517 uses a TDI sensor (Col. 23, lines 32+).

Hara '690 discloses a pattern detecting apparatus having a light source 11 emitting light in a plurality of wavelengths. The light passes through a condenser lens 12 and a filter 16 that extracts and passes light in a specific range of wavelengths (*e.g.*, 300-460nrn; 370nm max). Another filter 18 selects a range of light emitted from the object. Detectors are used to determine defects. No TDI sensor is disclosed. Similarly, Hara '686 discloses a method and apparatus for detecting wiring patterns comprising a broad spectrum light source 11 emitting light

in multiple wavelengths, the light passing through a condenser lens 21 and filter 22. Filter 22 selects a light ray of a wavelength range of 300-460nm (blue filter). The light causes fluorescence of the object layer that produces light that passes through another filter 24 selecting a specific wavelength range (yellow filter) of everything greater than 500nm. Again, no TDI sensor is disclosed.

Kohno '867 discloses in Col. 3, lines 47+, a surface condition inspection system having an illumination system comprising a light source 20 that can be a halogen lamp (wide spectrum) with a light filter. The filter selects a range of wavelengths (Col. 9, lines 51+). The light passes though a condenser lens. Photosensors are used with circuitry to inspect wafer 5. A spatial filter can be used on the reflection side (Col. 5, lines 13+). Once again, no TDI sensor is disclosed.

Ninomiya '794 discloses a method and apparatus for measuring an integrated chip. A broad-spectrum light source emits light of plural wavelengths (mercury lamp). Any of a plurality of filters can be moved into a position between the light source and sensors. The filters are of numerous types including, in part, wavelength selection filters and polarizing filters. See Figure 3 and Col. 7, lines 63+. Col. 9, lines 9+ indicates that the filters can select a band-pass range of wavelengths. No TDI sensor is disclosed.

Worster '252 discloses a wafer inspection system using a "multi-line" laser source that emits laser light in plural wavelengths. A "notch" filter is used to select one wavelength, but the filter can also be made to select plural "lines" of wavelengths (Col. 6, lines 48+). The system can also use polarization and spatial filters. In addition, a white light source can be used simultaneously with the laser source. No TDI sensor is disclosed.

Hayano '510 discloses an apparatus for detecting foreign particles on the surface of a reticle or pellicle, the apparatus having broad spectrum light sources 10/14 and wavelength selection filters 41/43 that select certain wavelengths. Note Col. 8, lines 54+ and Figure 7. No TDI sensor is disclosed.

Japan 63-055445 discloses an "appearance" inspection system for detecting defects in solid objects, the system having a light source 3 that emits broad spectrum light which passes through a selected light transmission filter 4.

To summarize, Chadwick '326 and '517 appear, in Applicant's opinion, to be most relevant. However, Applicant's claims are distinguished and patentable because (at the minimum) Chadwick '326 and '517 do no use an objective lens for illuminating the specimen and collecting light reflected form the specimen by the illumination. Further, neither reference discloses or suggests selecting a wavelength range to prevent interference of lights reflected from the wafer by the illumination.

FIELD OF SEARCH

The search was conducted in Class 356, Subclasses 394, 416, 417, 420, 239.3, 239.8, 237.3, 237.4 and 237.5; Class 348, Subclass 126; and Class 383, Subclasses 144, 145, 147 and 149. Also, the automated search system of the USPTO was employed to review US patents as well as EPO/Japanese documents associated with these subclasses. In addition, numerous broad keyword searches of the entire databases were performed.

CONCLUSION

In view of the foregoing statements and the attached, Applicant respectfully requests that this Petition to Make Special be granted, and that this application be

accorded expedited examination and issue under the special procedures for accelerated examination as set forth at MPEP §708.02(VIII)

This Petition and the concurrent submissions are being filed prior to examination of this application and preparation of a first Action on the merits, and are therefore timely. No Petition for extension of time is possible for entry of this paper. Submitted concurrently herewith is a Supplemental Preliminary Amendment, as well as a Form PTO-2038 including authorization for payment of the Petition fee (Fee Code 1460). Please charge any valid deficiency in fees required for this submission to ATSK Deposit Account No. 01-2135 (as Case 501.33745CX4).

Respectfully submitted,

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Attachments:
Form PTO-1449
Five (5) US Refs./One (1) JP Ref.
with English Abstract

Concurrent Submissions:
Supplemental Preliminary Amendment
Form PTO-2038 (Fee Codes 1460/1201/1202)

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SUPPLEMENTAL PRELIMINARY AMENDMENT

Commissioner for Patents
POB 1450
Alexandria, Virginia 22313-1450

29 April 2004

Sir:

Prior to examination on the merits in the above-identified application, the following amendments and remarks are respectfully submitted.

In accordance with the revised format of the manner of making amendments under 37 CFR §1.121 as set forth in the Final Rule effective 30 July 2003, each section of amendment herein begins on a new page, and changes are shown by strike-through (or double brackets where appropriate) and underlining to indicate deletions and additions, respectively. A complete listing of all claims ever presented in the application is given with the current status of each claim, and only the text of all pending and withdrawn claims is presented in full, with those not being amended herein being presented in clean version.

IN THE CLAIMS:

1.-42. (Canceled)

43. (Currently Amended) A method of inspecting a patterned wafer, comprising:

emitting light containing a plurality of wavelengths from a light source;

illuminating the patterned wafer with the light through a lens;

detecting through the lens with a sensor, an image of a pattern on the patterned wafer as illuminated by the light, and outputting from the sensor, a signal concerning a detected image; and

processing the signal outputted from the sensor and obtaining information of defects of the pattern;

wherein light components having a predetermined wavelength range ~~as~~ are selected from the light emitted from the light source for preventing interference of lights reflected from the wafer by the illuminating, and are used to illuminate the patterned wafer.

44. (Previously Presented) A method according to the Claim 43, wherein in the detecting, the image of the pattern is detected by a time delay integration sensor.

45. (Previously Presented) A method according to the Claim 43, wherein in the illuminating, the patterned wafer is illuminated with ultra violet light selected from the light emitted from the light source.

46. (Previously Presented) A method according to the Claim 43, wherein in the illuminating, a wavelength selection filter selects the light components having a predetermined wavelength range of 600 nm or under from the light emitted from the light source.

47. (Currently Amended) A method of inspecting a patterned wafer, comprising:

illuminating a specimen through an objective lens with wavelength light having a predetermined wavelength range as selected from light having a plural wavelengths emitted from a light source for preventing interference of lights reflected from the wafer by the illuminating;

detecting with a time delay integration sensor, a light reflected from the patterned wafer by the wavelength light and passed through the objective lens; and

processing the output signal from the time delay integration sensor and obtaining information relating to a defect of the patterned wafer.

48. (Previously Presented) A method according to the Claim 47, wherein in the illuminating, the patterned wafer is illuminated with ultra violet light selected from the light emitted from the light source.

49. (Previously Presented) A method according to the Claim 48, wherein the time delay integration sensor outputs signals in parallel, and the signals outputted in parallel are processed in parallel in the processing operation.

50. (Previously Presented) A method according to the Claim 47, wherein in the processing, the output signal from the time delay integration sensor is processed using a variable defect detection sensitivity which varies according to a position on the patterned wafer.

51. (Previously Presented) A method according to the Claim 47, wherein in the processing, the output signal from the time delay integration sensor is processed using a variable defect detection sensitivity which varies according to the pattern being inspected.

52. (Currently Amended) An apparatus for inspecting a patterned wafer, comprising:

a light source to emit light containing a plurality of wavelengths;

an illuminating unit to illuminate the patterned wafer with light emitted from the light source;

a detecting unit to detect an image of a pattern on the patterned wafer as illuminated by the illuminating unit, and to output a signal concerning a detected image; and

a processing unit to process the signal outputted from the detecting unit and to obtain information of defects of the pattern;

wherein, the illuminating unit selects predetermined light components having a predetermined wavelength range ~~as selected~~ from the light emitted from the light source <u>for preventing interference of lights reflected from the wafer by the illuminating</u>, to illuminate the patterned wafer.

53. (Previously Presented) An apparatus according to the Claim 52, wherein the detecting unit detects the image of the pattern with a time delay integration sensor.

54. (Previously Presented) An apparatus according to the Claim 52, wherein the light source emits ultra violet light, and the illuminating unit selects the ultra violet light from the light emitted from the light source as the predetermined light components having a predetermined wavelength range.

55. (Previously Presented) An apparatus according to the Claim 52, wherein the light source is a lamp.

56. (Previously Presented) An apparatus according to the Claim 52, wherein the processing unit processes the signal outputted from the detecting unit with a variable defect detection sensitivity which varies according to a position on the patterned wafer.

57. (Previously Presented) An apparatus according to the Claim 52, wherein the processing unit processes the signal outputted from the detecting unit with a variable defect detection sensitivity which varies according to the pattern being inspected.

58. (Currently Amended) An apparatus for inspecting a patterned wafer, comprising:

a light source to emit light containing plural wavelengths;

an illuminating unit having an objective lens to illuminate the patterned wafer through the objective lens with wavelength light having a predetermined wavelength range as selected from the light emitted from the light source for preventing interference of lights reflected from the wafer by the illuminating;

a detecting unit to detect an image of the patterned wafer as illuminated by the illuminating unit through the objective lens, with a time delay integration sensor; and

a processing unit to process an output signal from the time delay integration sensor and to obtain information relating to a defect of the patterned wafer.

59. (Previously Presented) An apparatus according to the Claim 58, wherein the light source emits ultra violet light, and the illuminating unit selects the ultra violet light from the light emitted from the light source, to illuminate the patterned wafer.

60. (Previously Presented) An apparatus according to the Claim 58, wherein the illuminating unit includes a wavelength selection filter to select light components having a predetermined wavelength range of 600 nm or under from the light emitted from the light source, to illuminate the patterned wafer.

61. (Previously Presented) An apparatus according to the Claim 58, wherein the processing unit processes the signal outputted from the detecting unit with a variable defect detection sensitivity which varies according to a position on the patterned wafer.

62. (Previously Presented) An apparatus according to the Claim 58, wherein the processing unit processes the signal outputted from the detecting unit with a variable defect detection sensitivity which varies according to the pattern being inspected.

63. (New) A method according to Claim 47, wherein a wavelength selection filter for selecting wavelengths from the light is disposed between the light source and the objective lens.

64. (New) A method according to Claim 47, wherein a wavelength selection filter for selecting the wavelength light is disposed between the light source and the objective lens.

65. (New) An apparatus according to Claim 52, comprising a wavelength selection filter disposed between the light source and the objective lens selects the predetermined light components.

66. (New) An apparatus according to Claim 58, comprising a wavelength selection filter disposed between the light source and the objective lens selects the wavelength light.

67. (New) An apparatus for inspecting a patterned wafer, comprising:

a light source to emit light containing a plurality of wavelengths;

a non-interference light selector including a filter to select predetermined wavelengths from the light emitted from the light source for preventing interference of lights reflected from the wafer, to illuminate the patterned wafer;

an objective lens to pass the predetermined wavelengths from the non-interference light selector to the patterned wafer;

a detecting unit to detect an image of a pattern on the patterned wafer as illuminated by the predetermined wavelengths and reflected back through the objective lens, and to output a signal concerning a detected image; and

a processing unit to process the signal outputted from the detecting unit and to obtain information of defects of the pattern.

REMARKS

This Supplemental Preliminary Amendment presents amendments as identified above, and information as indicated below.

PENDING CLAIMS

Original Claims 1-42 were previously canceled without prejudice or disclaimer of any scope or subject matter, and new Claims 43-62 were presented. Appropriate claims have been amended and added herein to adjust a clarity and/or focus of Applicant's claimed invention. That is, such changes are unrelated to any prior art or scope adjustment, and are simply refocused claims in which Applicant is present interested. At entry of this paper, Claims 43-67 are pending for consideration and examination in the application.

RESERVATION OF RIGHTS

It is respectfully submitted that any and all claim amendments and/or cancellations submitted within this paper and throughout prosecution of the present application are without prejudice or disclaimer of any scope or subject matter. Further, Applicant respectfully reserves all rights to file subsequent related application(s) (including reissue applications) directed to any/all previously claimed limitations/features which have been subsequently amended or cancelled, or to any/all limitations/features not yet claimed, *i.e.*, Applicant continues (indefinitely) to maintain no intention or desire to dedicate or surrender any limitations/features of subject matter of the present application to the public.

EXAMINER INVITED TO TELEPHONE

The Examiner is invited to telephone the undersigned at the local D.C. area number of 703-312-6600, to discuss an Examiner's Amendments or other suggested action for accelerating prosecution and moving the present application to allowance.

CONCLUSION

In view of the foregoing amendments and remarks, Applicant respectfully submits that the claims listed above as presently being under consideration in the application are in condition for allowance. Accordingly, early allowance of such claims is respectfully requested.

This Supplemental Preliminary Amendment is submitted prior to a first Action on the merits and does not interfere with preparation of such an Action, and therefore is timely. No Petition or fee is possible for entry of this paper.

Respectfully submitted,

Paul J. Skwierawski
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Facsimile 703-312-6666

Sheet 1 of 1

Form PTO-1449 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTY. DKT. NO.	SERIAL NO.
	501.33745CX4	10/686,584
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use several sheets if necessary)	**APPLICANT** Shunji MAEDA *et al.*	
	FILING DATE 17 October 2003	**GROUP** 2877

U.S. PATENT DOCUMENTS

Ex. Initial		Doc. No.	Date	Name	Class	Subclass	Filing Date
	AA	4,692,690	09/08/1987	Hara *et al.*			
	AB	4,816,686	03/28/1989	Hara *et al.*			
	AC	4,999,510	03/12/1991	Hayano *et al.*			
	AD	5,162,867	11/10/1992	Kohno			
	AE	5,459,794	10/17/1995	Ninomiya *et al.*			
	AF						
	AG						
	AH						

U.S. PATENT APPLICATIONS

		Application Number	Name	Publication Date
	AI			
	AJ			
	AK			
	AL			

FOREIGN PATENT DOCUMENTS

		Doc. No.	Date	Country	Class	Subclass	Translation/Abstract	
							Yes	No
	AM	63-055455 A	03/09/1988	JP			Abstract	
	AN							
	AO							
	AP							
	AQ							
	AR							
	AS							
	AT							

OTHER DOCUMENTS

	AU	
	AV	
	AW	
	AX	

Examiner	Date Considered

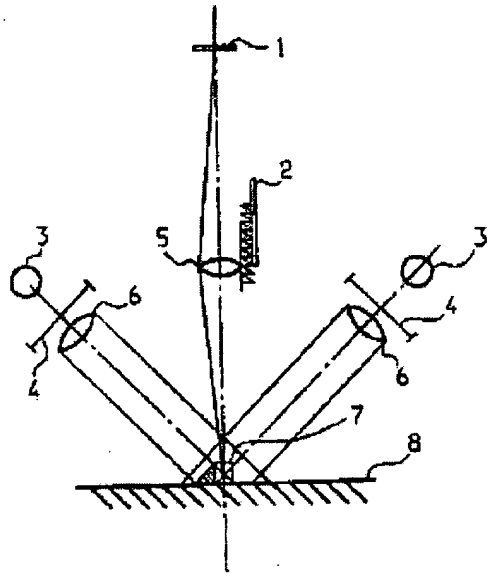
APPEARANCE INSPECTION SYSTEM

Patent number:	JP63055445
Publication date:	1988-03-09
Inventor:	TOYODA HIROAKI
Applicant:	HITACHI LTD
Classification:	
- international:	G01N21/88; G02B27/02; H01L21/66; H05K3/00
- european:	
Application number:	JP19860198805 19860827
Priority number(s):	

Abstract of **JP63055445**

PURPOSE:To detect the defect of a solid and a non-specific shape with high accuracy by radiating spot light beams being in the relation of a complementary by radiating spot light beams being in the relation of a complementary color to each other, to a surface to be inspected.

CONSTITUTION:The surface to be inspected 8 is driven by an XY table, etc., a light beam radiated from a light source 3 is allowed to pass through a selected light transmission filter 4, and a light beam having only a specific wavelength component is converged 6, and radiated to only the specific inspection range of the surface to be inspected 8. In such a case, an illuminating optical axis is constituted so as to be illuminated from an oblique direction to the surface to be inspected 8, and also, on the surface being different from the surface containing this illuminating optical axis, in a vertical direction to the surface to be inspected 8, plural illuminating equipments are placed and an illumination is executed so that light beams being in a complementary color relation each other to wavelength selected by the filter 4 are superposed to each other on the surface to be inspected 8. In such a way, the surface to be inspected 8 illuminated by the complementary color illuminating equipment is brought to an image formation on an image pickup device 1 by a focusing helicoid 5, and by detecting a reflected light component of the surface to be inspected 8 and detecting a detected defect 7, the surface to be inspected is inspected.



ORIGINAL REFERENCE IS UNAVAILABLE

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 63-055445

(43)Date of publication of application : 09.03.1988

(51)Int.Cl. G01N 21/88
G02B 27/02
H01L 21/66
H05K 3/00

(21)Application number : 61-198805

(22)Date of filing : 27.08.1986

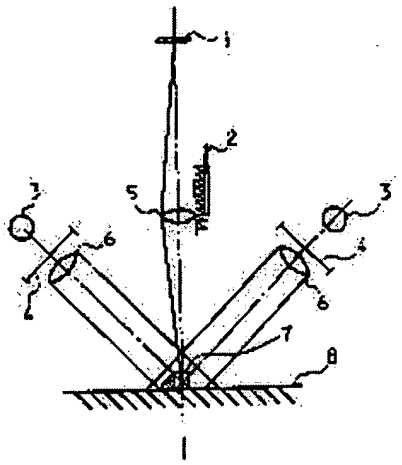
(71)Applicant : HITACHI LTD

(72)Inventor : TOYODA HIROAKI

(54) APPEARANCE INSPECTION SYSTEM

(57)Abstract:

PURPOSE: To detect the defect of a solid and a non-specific shape with high accuracy by radiating spot light beams being in the relation of a complementary by radiating spot light beams being in the relation of a complementary color to each other, to a surface to be inspected.



CONSTITUTION: The surface to be inspected 8 is driven by an XY table, etc., a light beam radiated from a light source 3 is allowed to pass through a selected light transmission filter 4, and a light beam having only a specific wavelength component is converged 6, and radiated to only the specific inspection range of the surface to be inspected 8. In such a case, an illuminating optical axis is constituted so as to be illuminated from an oblique direction to the surface to be inspected 8, and also, on the surface being different from the surface containing this illuminating optical axis, in a vertical direction to the surface to be inspected 8, plural illuminating equipments are placed and an illumination is executed so that light beams being in a complementary color relation each other to wavelength selected by the filter 4 are superposed to each other on the surface to be inspected 8. In such a way, the surface to be inspected 8 illuminated by the complementary color illuminating equipment is brought to an image formation on an image

pickup device 1 by a focusing helicoid 5, and by detecting a reflected light component of the surface to be inspected 8 and detecting a detected defect 7, the surface to be inspected is inspected.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Patent & Utility Model Concordance

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Document Number list

	1	2	3	4	5
Application Number	63-055445(1988)				
Unexamined Publication Number	JP,01-228823,A (1989)				
Examined Publication Number					
Registration Number	JP,2617975,B				

Please choose a Kind code with Display Type.

Kind code Unexamined **Display Type** All Pages

List Stored Data

Family list
2 family member for:
JP63055445
Derived from 1 application.

1 **APPEARANCE INSPECTION SYSTEM**
Publication info: **JP2914967B2 B2** - 1999-07-05
JP63055445 A - 1988-03-09